

ECE 312 Project Description

Self-Watering Plant Device

Lab Day: M T W R F

Member Name

- | | Member Name |
|----|---------------------------|
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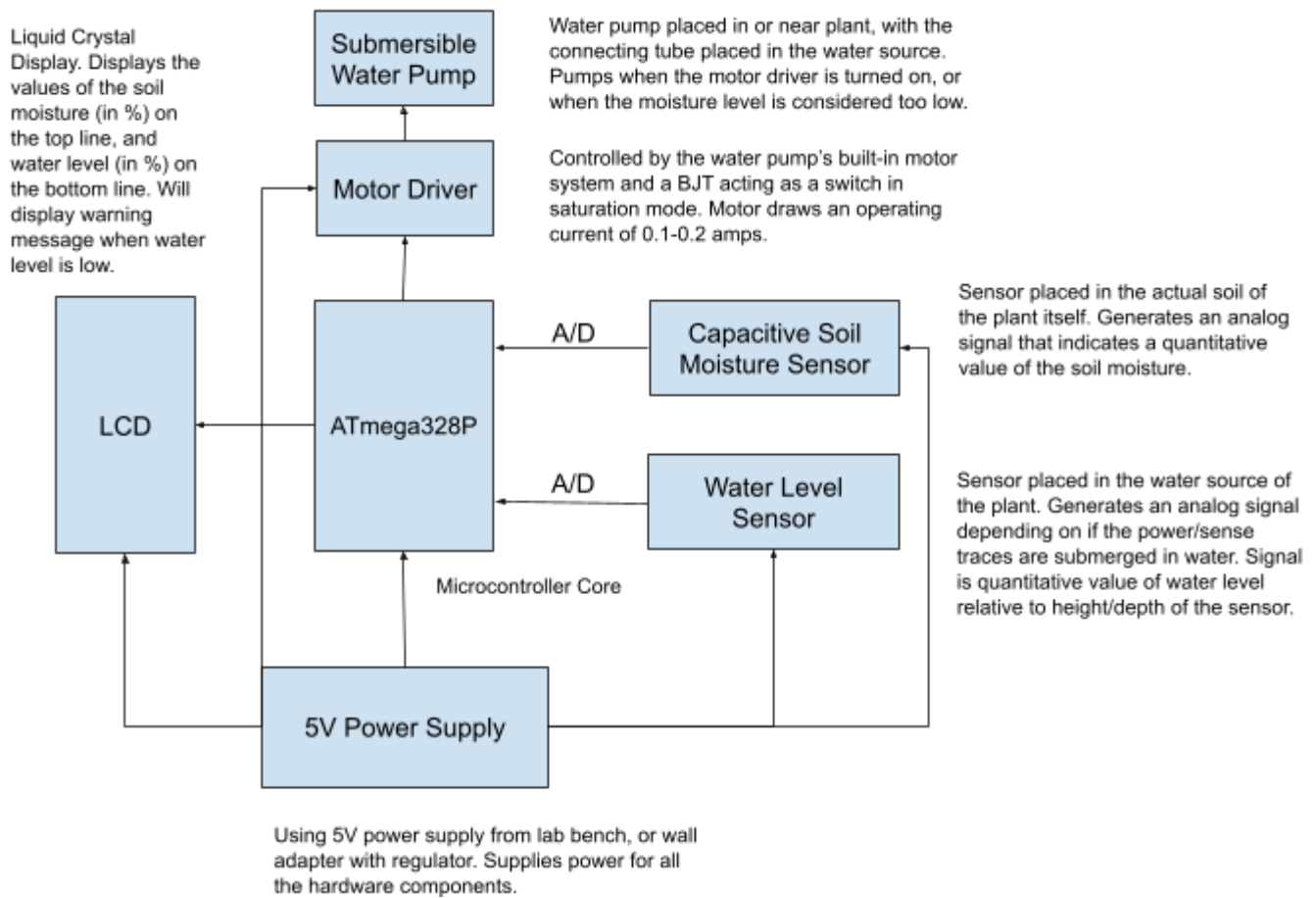
Brief Description

This project is based on trying to relieve any stress from having to look after house plants that need constant care, since improper care can cause these plants to die very quickly. In order to achieve this, we first analyzed what these plants needed in order to be taken care of properly. Assuming these plants are kept in a well lit house, the only factor that the plant needs to survive is sufficient water. Therefore, our project will be based around finding the moisture it is receiving, and if insufficient, we will supplement it to an appropriate amount automatically, and if the source of water is low, we will alert the user to refill the source.

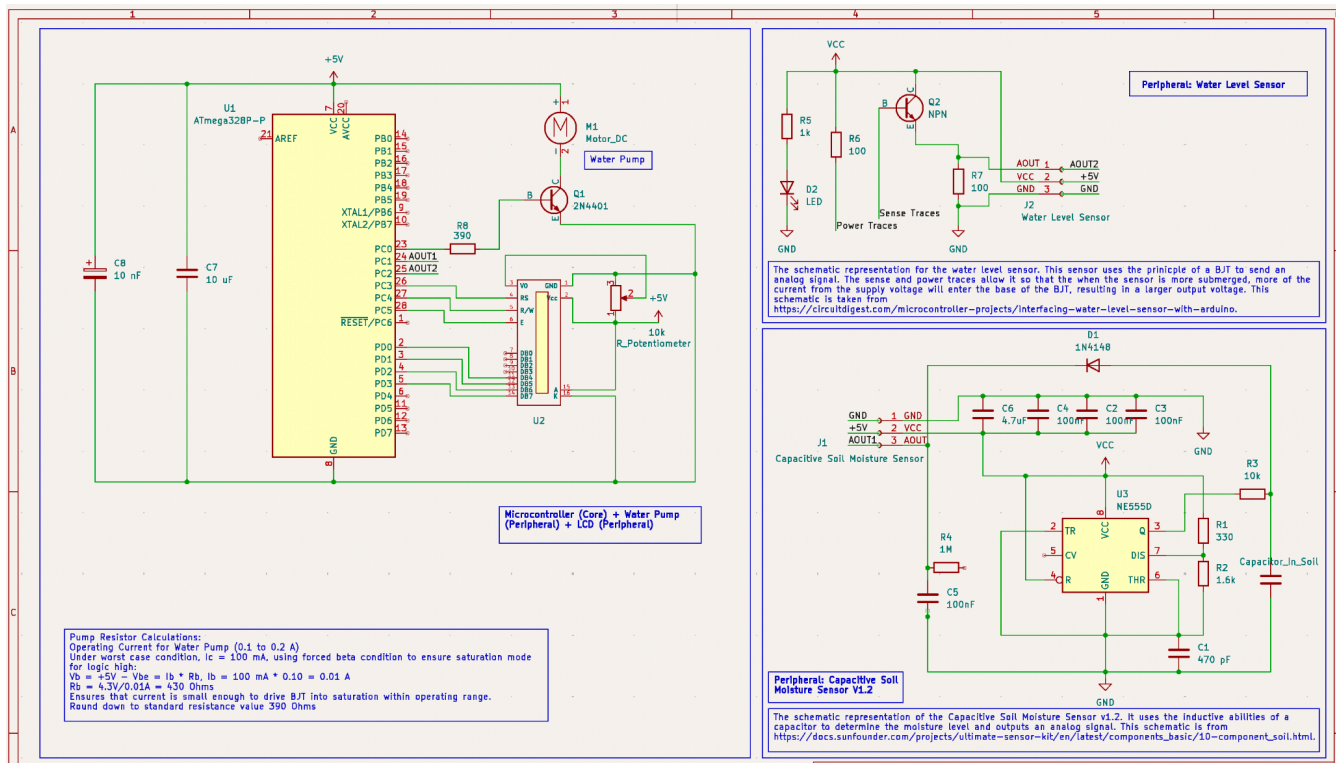
Target Specifications

1. Use the ATmega328P as the core microcontroller within the design as it has multiple A/D pins, powered by a 5V power supply.
2. Accurate detection of plant soil moisture content (in %) with a capacitive soil sensor.
3. Display the soil moisture content of the plant on the top line of a 16x2 LCD.
4. Use and automate electric water pumps to supplement water periodically every 10-20 seconds, while the plant's moisture level is below the defined threshold (from around 20% to 50% depending on the plant).
5. Automatic detection of the physical water depth of the water source for the plant, done through the use of the analog output of the water level sensor
6. Display the water level of the water source and notify the user with a warning message when the water level is low on the bottom line of a 16x2 LCD.

Hardware Block Diagram



Schematic



Estimated Power Consumption

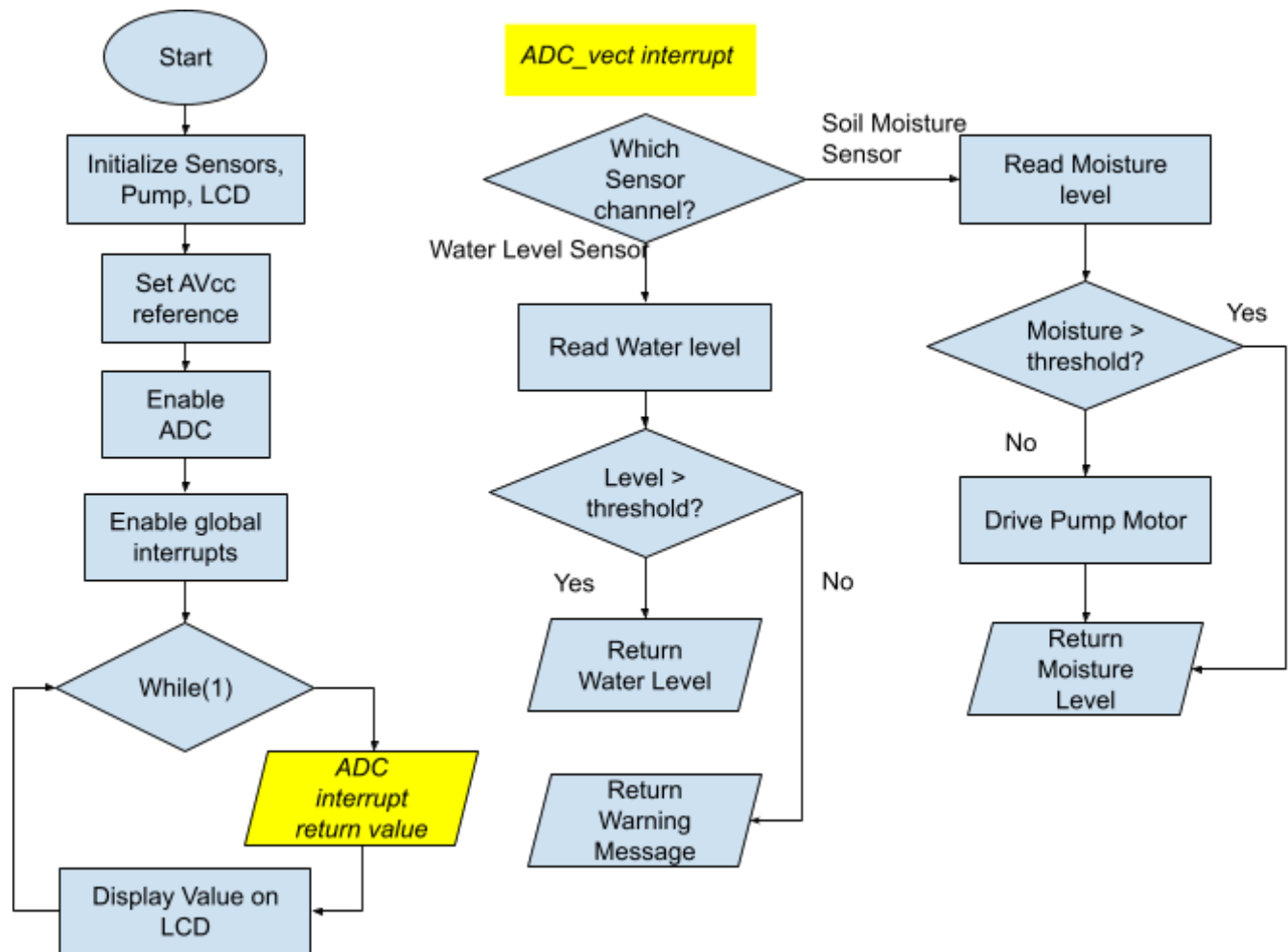
Device/Component	Operating Voltage	Operating Current	Power	Source
ATmega328P (Active 8MHz)	+5V	10 mA (at max)	0.05 W	https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf
Capacitive Soil Moisture Sensor	+5V	5 mA	0.025 W	https://media.digikey.com/pdf/data%20sheets/dfrobot%20pdfs/sen0193_web.pdf
Water Level Sensor	+5V	20mA (at max)	0.1 W	https://www.biomaker.org/block-catalogue/2021/12/17/water-level-sensor-tzt-water-level-sensor
LCD	+5V	1.5 mA (typ.)	0.0075 W	https://www.sparkfun.com/datasheets/LCD/GDM1602K-Extended.pdf

10k Potentiometer	+5V	0.5 mA	0.0025 W	Estimate
Components that consume power when the water pump is activated (Device Active Mode)				
Micro Submersible Water Pump	+5V	0.1-0.2 A	1 W (At max)	https://www.mybotic.com/my/water-pump/micro-submersible-water-pump-dc-3v-5v
BJT (2N4401)	+0.4 V (CE voltage in saturation from datasheet)	0.1-0.2 A (Collector current determined from pump motor)	0.08 W (At max)	https://www.onsemi.com/download/data-sheet/pdf/2n4401-d.pdf
Resistor	+4.3 V (BE voltage set to 0.7 V)	0.01 (Base current estimate to ensure saturation mode)	0.043 W	https://forum.digikey.com/t/digital-switching-transistor-saturation-and-forced-beta/37293

Power Consumption Table

Mode	Power	Power Consumption
Pump not activated (Idle)	0.185 W	0.000185 kWh
Pump activated (Active)	1.308 W	0.001308 kWh

Firmware Plan



Parts Needed

Part Description/Number	Number Required	Return
2N4401 BJT Transistor	1	<input type="checkbox"/>
390 Ohm $\frac{1}{4}$ W 5% Standard Resistor	1	<input type="checkbox"/>

Parts from Other Sources

1. 1 Capacitive Soil Moisture Sensor (Provided by ourselves)
2. 1 Water Level Sensor (Provided by ourselves)
3. 1 Mini Water Pump DC 3V-5V (Provided by ourselves)
4. 1 16 x 2 LCD (From Lab Kit)
5. 1 ATmega328P (From Lab Kit)
6. 1 10K Potentiometer (From Lab Kit)
7. 1 10 nF Capacitor (From Lab Kit)
8. 1 10 uF Capacitor (From Lab Kit)